

CLAIMS

What is claimed is:

1 1. In a communication network system having at least a first switch and a second
2 switch communicatively coupled together by a plurality of links, the first switch having at
3 least a plurality of first ports, and the second switch having at least a plurality of second
4 ports, each of the links communicatively coupling one of the first ports to a
5 corresponding one of the second ports, a method of routing frames received at the first
6 switch to the second switch, the method comprising:

7 selecting a new port from the first and second ports;

8 adding the new port to a trunked group in response to determining whether the
9 new port qualifies as a trunking port;

10 selecting a pair of trunking ports to be trunking master ports; and

11 responsive to the first switch receiving frames, the trunking master ports

12 selectively controlling the frames routed over the trunked group to the
13 second switch.

1 2. The method according to Claim 1, wherein the first ports and the second ports
2 comprise E_Ports.

1 3. The method according to Claim 1, wherein selecting a new port from the first
2 and second ports comprises:

3 sending a request to exchange link parameters associated with the new port;

4 receiving a response for the request, the response including a first identifier;

5 determining whether a second identifier exists, the second identifier having a

6 higher value than the first identifier; and

7 determining whether the link parameters exchanged successfully.

1 4. The method according to Claim 3, wherein the first identifier and the second
2 identifier each comprises a World Wide Name.

1 5. The method according to Claim 1, wherein determining whether the new port
2 qualifies as a trunking port comprises:

- 3 determining a one way skew value for the links associated with the trunked
- 4 group; and
- 5 determining whether the new port can be added to the trunked group based on
- 6 the one way skew value determined.

1 6. The method according to Claim 5, wherein adding the new port to a trunked
2 group comprises:

- 3 determining whether the new port is configured as a trunked port;
- 4 determining whether a link associated with the new port communicates frames
- 5 at a speed substantially similar to other links in the trunked group;
- 6 verifying that the new port resides on one of the first and second switches; and
- 7 determining that the one way skew value is within a predetermined range.

1 7. The method according to Claim 5, wherein determining a one way skew value
2 comprises:

- 3 measuring a difference in propagation delay between the links associated with
- 4 the trunked group.

1 8. The method according to Claim 7, wherein the difference in propagation delay
2 is measured by:

- 3 sending a MARK sequence from particular ones of the first ports to particular
- 4 ones of the second ports; and
- 5 determining a timestamp associated with receiving the MARK sequence sent.

1 9. The method according to Claim 7 wherein the difference in propagation delay
2 is measured by:

- 3 receiving a MARK sequence sent from particular ones of the first ports;
- 4 associating a clock timestamp value responsive to receiving the MARK
- 5 sequence; and

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6 sending a response to the first switch, the response including the date
7 timestamp value.

1 10. The method according according to Claim 1, wherein selecting a pair of
2 trunking ports to be trunking master ports comprises:
3 determining that the new port does not belong to an existing trunked group;
4 and
5 designating the new port as a trunking master port.

1 11. The method according to Claim 1, wherein the trunking master ports
2 selectively controlling the frames routed over the trunked group to the second switch
3 comprises:
4 associating one of a plurality of lists with each of the first ports; and
5 binding one of the lists associated with a trunking master port to a
6 corresponding one of the links in the trunked group for a time period,
7 the time period enabling a frame to be
8 transmitted from the first switch to the second switch, and
9 received at the second switch with "in order" delivery.

1 12. The method according to Claim 1, wherein one of the pair of trunking master
2 ports comprises a transmit port routing the frames over the trunked group.

1 13. The method according to Claim 13, wherein the other of the pair of trunking
2 master ports comprises a receive port queuing frames received over the trunked group.

1 14. The method according to Claim 1, wherein the frames are routed over the
2 trunked group prior to performing a Link Reset Protocol during a fabric initialization
3 process.

1 15. A computer-implemented method of distributing traffic load amongst a
2 group of links communicatively coupling a pair of adjacent switches, the method
3 comprising:

- 4 identifying a set of transmit and receive ports for the group, the transmit ports
- 5 being associated with one of the switches and the receive ports being
- 6 associated with the other of the switches;
- 7 designating one of the transmit ports as a master transmit port and one of the
- 8 receive ports as a master receive port;
- 9 queuing the traffic load received at the transmit ports through a queue
- 10 associated with the master transmit port; and
- 11 routing the traffic load from the queue across the group so that the links
- 12 transmit the traffic load in an evenly-distributed manner.

1 16. The computer-implemented method of Claim 15, further comprising:
2 receiving the traffic load routed across the group at the other of the switches;
3 and
4 queuing the traffic load received through a queue associated with the master
5 receive port in an order received.

1 17. The computer implemented method of Claim 16, wherein the traffic load is
2 routed across the group by:
3 associating one of a plurality of lists with each of the transmit ports; and
4 binding one of the lists associated with the master transmit port to a
5 corresponding one of the links in the group for a time period, the time
6 period enabling the traffic load to be received at the other of the
7 switches with “in order” delivery.

1 18. The computer-implemented method according to Claim 17, wherein the
2 switches are part of a fabric in a communication network system.

1 19. The computer-implemented method according to Claim 18, wherein the
2 traffic load comprises a plurality of frames.

1 20. A communication network system, comprising:
2 at least a first switch and a second switch communicatively coupled together
3 by a plurality of links;
4 a group including selected ones of the links;
5 a plurality of at least first and second ports, the first ports being coupled to the
6 first switch and the second ports being coupled to second switch, each
7 of the selected ones of the links having a pair of ends coupled to
8 corresponding ones of the first ports and the second ports; and
9 a pair of transmit and receive ports selected respectively from one of the first
10 ports and from one of the second ports, the transmit port routing
11 frames received at the first switch across the group to the second
12 switch.

1 21. The system according to Claim 20, further comprising:
2 first queuing logic coupled to the transmit port, the first queuing logic
3 enabling frames received at the first ports to be routed through the
4 transmit port and across the group so that the selected ones of the links
5 transmit the frames in an evenly-distributed manner.

1 22. The system according to Claim 21, further comprising:
2 second queuing logic coupled to the receive port, the second queuing logic
3 enabling frames routed across the group to be received at the second
4 switch according to an order of arrival.

1 23. The system according to Claim 22, further comprising:
2 a timer binding a particular list associated with the transmit port to a particular link in
3 the group for a period of time to ensure "in-order" delivery of frames
4 transmitted across the group.

1 24. The system according to Claim 23, wherein the timer comprises:
2 a programmable timeout constant register.

1 25. The system according to Claim 23, wherein the first ports and the second ports
2 comprise E_Ports.

1 26. The system according to Claim 23, wherein the links comprise ISLs.

1 27. The system according to Claim 23, further comprising a one way link timer.

1 28. The system according to Claim 23, further comprising:
2 a Fibre Channel fabric, the first switch and the second switch forming a part of the
3 fabric.

1 29. A computer readable medium, comprising:
2 computer executable instructions thereon, the instructions routing frames received at
3 a first switch to a second switch, the first switch and the second switch being
4 communicatively coupled together by a plurality of links, the first switch
5 having at least a plurality of first ports, and the second switch having at least a
6 plurality of second ports, each of the links communicatively coupling one of
7 the first ports to a corresponding one of the second ports, and including:
8 selecting a new port from the first and second ports;
9 adding the new port to a trunked group in response to determining whether
10 the new port qualifies as a trunking port;
11 selecting a pair of trunking ports to be trunking master ports; and

12 responsive to the first switch receiving frames, the trunking master ports
13 selectively controlling the frames routed over the trunked group to
14 the second switch.

1 30. A computer readable medium, comprising:

2 computer executable instructions thereon, the instructions distributing traffic load
3 amongst a group of links communicatively coupling a pair of adjacent
4 switches, and including:

5 identifying a set of transmit and receive ports for the group, the transmit
6 ports being associated with one of the switches and the receive
7 ports being associated with the other of the switches;

8 designating one of the transmit ports as a master transmit port and one of
9 the receive ports as a master receive port;

10 queuing the traffic load received at the transmit ports through a queue
11 associated with the master transmit port; and

12 routing the traffic load queued across the group so that the selected ones of
13 the links transmit the traffic load in an evenly-distributed manner.
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